Prevalence of frailty status among the European elderly population: Findings from the Survey of Health, Aging and Retirement in Europe

Prevalence of frailty status among European elderly population: findings from the Survey of Health, Ageing and Retirement in Europe (SHARE)

Running title: Frailty status among European elderly population

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Abstract

Frailty is a geriatric multidimensional syndrome whose signs and symptoms of which are predictors of increased vulnerability to minor stress events and risk of adverse outcomes such as falls, fractures, hospitalisation, disability and death. In this work, we aimed to update the data of frailty status in the European community dwelling population, based on the latest data released (wave 6) of the Survey of Health, Ageing and Retirement in Europe (SHARE) database. Frailty status was assessed applying a version of the Fried Phenotype operationalised for SHARE. Moreover, we aimed to study the impact of each of the five criteria in frailty assessment.

We included all participants who answered all the questions used in a frailty assessment and who disclosed their gender and, further, whose age was 50 or more. Our final sample was 60,816 individuals. Of these, the mean age was 67.45 ± 9.71 years; 38,497 (56.4%) were female.

The global prevalence of pre-frailty and frailty was 42.9% (ranging from 34.0% in Austria to 52.8% in Estonia) and 7.7% (ranging from 3.0% in Switzerland to 15.6% in Portugal). Pre-frailty and frailty prevalence increased along age and were more frequent among women. Regarding the five criteria considered on frailty assessment, exhaustion seems to be the criterion that contributes most to frailty status, followed by low activity, weakness, loss of appetite and slowness.

With this work, we demonstrated that more than 50% of the 50+ European population are pre-frail/frail, which must be considered when designing interventions to reduce/postpone/mitigate the progression of this condition, reducing the burden associated with it.

Keywords: Frailty; SHARE; Disability; Community; Public health; Elderly

Introduction

Ageing of the European population, also known as ‘the greying of Europe’, is a demographic phenomenon that results from a low number of births along with an increasing average life expectancy (1–3). In 1950, only 12% of the European population was over 65 years old. Today, that number has almost doubled, rising to 19.2%; projections show that by 2050 more than 36% of the European population will be 65 years or older (4,5). However, living longer is not necessary linked with an active, healthy and independent ageing (6). Indeed, unhealthy life years are about 20% of a person's life (7). Increased longevity leads to a greater expression of chronic diseases related to ageing, comorbidities and geriatric syndromes, posing a serious challenge at economic and healthcare systems levels (8).

Over the last few years, several definitions of frailty have been provided; however, there is still no consensual definition for this condition. While its concept is already accepted, its definition is still somewhat controversial. There is common agreement that frailty is a geriatric multidimensional syndrome, the signs and symptoms of which predict increased vulnerability to minor stress events and adverse outcomes such as falls, fractures, hospitalisation, disability and death (9,10). The progression of this condition leads a robust elderly person to become pre-frail and then frail, and is associated with increased use of social and healthcare services (11). This geriatric syndrome represents a potentially huge public health problem due to the clinical and societal consequences of its dynamic nature, affecting not only the individual but his/her caregivers, the healthcare system and society (12).

There are several tools that can be used to assess this condition, using mainly functional, biological, psychological and social domains (13). Given the multitude of definitions for frailty, as well as tools for assessing this condition, there is an enormous variability in the prevalence levels within the

European population (14). There is general agreement that frailty is highly prevalent, affecting an average of 10% of the population aged 60 or older and 25% of 85 or older adults (10,15).

The Survey of Health, Ageing and Retirement in Europe (SHARE) is an international European database containing detailed information about the demographics, health, and social and economic status from representative samples of community-based populations over 50 years old (16). This project already has released data from six different waves, from 2004 to 2015, providing excellent opportunities to study frailty across Europe. The last detailed prevalence study published on frailty (17) used data collected in 2004. In this work we intend to update the data of frailty status at the European community dwelling population, based on the latest data released (wave 6 – data from 2015), applying a version of the Fried Phenotype operationalised to SHARE. Further, we aim to study the impact of each of the five criteria in frailty assessment.

Materials and methods

In this work, we used data from wave 6 of SHARE, collected in 2015. Wave 6 of SHARE has data from 68,231 individuals, aged between 24 and 106, from 18 countries: Austria, Germany, Sweden, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium, Israel, Czech Republic, Poland, Luxembourg, Portugal, Slovenia, Estonia and Croatia.

SHARE is a harmonised and cross-national database that allows consistent international comparisons of many factors simultaneously, providing a dynamic picture of ageing in Europe. A detailed description of the SHARE data and methodology has been published and is available to registered users on the SHARE website (http://www.share-project.org) (16).

Frailty Criteria Assessment

Pre-frailty and frailty were defined as previously described (18,19) using a SHARE operationalised version that is based on the five dimensions described by Fried *et al.* (10): exhaustion, shrinking, weakness, slowness and low activity:

1. The Exhaustion criterion was fulfilled as a positive answer to the question: 'In the last month, have you had too little energy to do the things you wanted to do?'.
2. The Shrinking criterion was fulfilled by reporting a 'diminution in desire for food', answering 'What has your appetite been like in the last month?' or, in the case of an uncodable answer to this question, by responding 'less' to 'So, have you been eating more or less than usual?'.
3. Weakness was derived from the highest of four consecutive dynamometer measurements of handgrip strength (two from each hand), adjusted by gender and body mass index (BMI). This criterion was met by men whose handgrip strength was ≤ 29 and whose BMI was ≤ 24, ≤ 30 for men with $24 < \text{BMI} \leq 28$, and ≤ 32 for men whose BMI > 28; and for women whose handgrip strength was ≤ 17 and whose BMI ≤ 23, ≤ 17.3 for women with $23 < \text{BMI} \leq 26$, ≤ 18

for women with 26 < BMI ≤ 29, and ≤ 21 for men whose BMI > 29, as proposed by Fried *et al.* (10).

4. The Slowness criterion was defined using mobility questions. Individuals who selected 'Climbing one flight of stairs without resting' or 'Walking 100 meters' to the question: 'Please tell me whether you have any difficulty doing each of the everyday activities on this card' fulfilled this criterion.
5. Low activity was satisfied in participants responding, 'One to three times a month' or 'hardly ever or never' to the question: 'How often do you engage in activities that require a low or moderate level of energy such as gardening, cleaning the car, or going for a walk?'.

One point was assigned for each fulfilled criterion; individuals with zero points were classified as robust, individuals with one or two points as pre-frail and with three to five points as frail (17).

Statistical Analysis

To assess the prevalence of frailty status of SHARE participants, and to understand the impact of each of the criteria in the assessment of frailty, we performed a descriptive analysis of the data collected. Four age groups were created (50–64, 65–74, 75–84, 85+ years old), and the prevalence results were standardised by age and gender, using the standard European population of 2013 (20); 95% confidence intervals (95% CI) were also calculated. Statistical analyses were performed using IBM SPSS (version 25).

Results

For this study, from all 68,231 SHARE's wave 6 participants, we included those who answered all the questions used on frailty assessment and gender inquiry and whose age was 50 or more. We thus arrived at a final sample of 60,816 individuals. Of these, the mean age was 67.45 ± 9.71 years old; 38,497 (56.4%) were female. Geographic distribution of pre-frail and frail individuals across Europe was unequal among the 18 evaluated countries **(Fig. 1A and 1B).** The global prevalence of pre-frailty was 42.9% (ranging from 34.0% to 52.8%). A high prevalence of pre-frailty was identified in Estonia (52.8%), Italy (49.7%) and Portugal (47.6%); whereas a low prevalence was found in Austria (34.0%), Slovenia (36.4%) and Denmark (37.0%) (**Table 1**). The global prevalence of frailty was 7.7%, ranging from 3.0% to 15.6%. Portugal, Israel and Poland were the countries with higher prevalences of frailty (15.6%, 14.0% and 13.1%, respectively) while Switzerland, Sweden and Denmark were the countries where this condition was less prevalent (3.0%, 4.2% and 5.0%, respectively) (**Table 2**).

An increasing prevalence of frailty status was found in individuals with higher ages. Indeed, a prevalence of pre-frailty and frailty in individuals aged 50–64 years old was 38.7% and 3.0% respectively, 41.7% and 6.0% for individuals aged 65–74 years old, 50.5% and 16.0% for those 75–84 years old and 52.3% and 32.8% for individuals 85 or more years old (**Table 1 and Table 2**). Substantial differences can then also be highlighted among genders. In fact, we found higher prevalences of pre-frailty and frailty in females (45.4% and 9.1% respectively), when compared to males (39.7% and 6.0% respectively) (**Table 1**).

Regarding the five criteria used on frailty assessment, exhaustion seems to be the criterion that contributes the most to frailty status (35.7 [35.2-36.1%]), followed by low activity (16.2 [15.9-16.5%]), weakness (15.8 [15.5-16.1%]), loss of appetite (8.3 [8.1-8.6%]) and slowness (5.5 [5.4-5.7%]) (**Table 3** and **Supplement Data 1**).

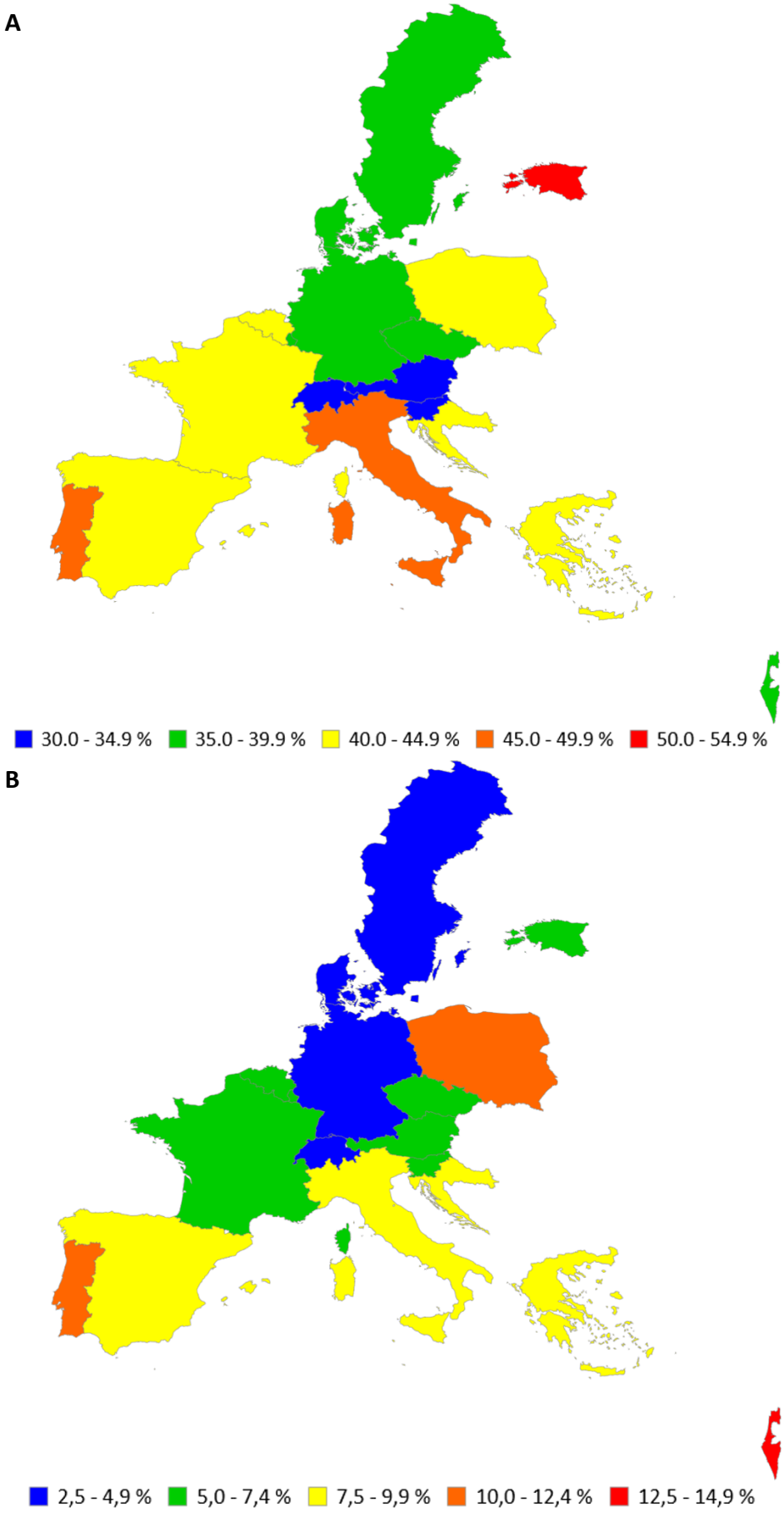

Figure 1 Prevalence of frailty status across Europe. A- Pre-frailty across Europe; B: Frailty across Europe.

Table 1 Prevalence of pre-frailty across Europe

	Overall					Male					Female				
	Overall prevalence (95% CI)	Standardised prevalence rates (95% CI)				Overall prevalence (95% CI)	Standardised prevalence rates (95% CI)				Overall prevalence (95% CI)	Standardised prevalence rates (95% CI)			
		50-64	65-74	75-84	≥85		50-64	65-74	75-84	≥85		50-64	65-74	75-84	≥85
Austria (n=2901)	34.0 (33.6-34.5)	28.9 (28.3-29.5)	31.8 (31.0-32.5)	44.6 (43.5-45.8)	43.9 (42.1-45.8)	31.2 (30.6-31.8)	26.3 (25.5-27.2)	28.3 (27.3-29.4)	37.5 (36.0-39.0)	53.7 (50.9-56.7)	36.2 (35.6-36.9)	30.6 (29.7-31.6)	34.5 (33.4-35.6)	49.9 (48.2-51.6)	38.1 (35.7-40.6)
Germany (n=4094)	38.7 (38.2-39.2)	36.4 (35.7-37.2)	37.0 (36.2-37.8)	41.2 (40.1-42.3)	51.6 (49.7-53.7)	36.0 (35.3-36.6)	33.7 (32.7-34.7)	34.6 (33.4-35.7)	37.5 (36.0-39.0)	50.0 (47.3-52.9)	41.4 (40.7-42.1)	38.5 (37.5-39.6)	39.6 (38.4-40.8)	45.6 (44.0-47.3)	53.3 (50.4-56.2)
Sweden (n=3682)	42.4 (41.9-42.9)	40.9 (40.2-41.7)	37.0 (36.2-37.8)	47.9 (46.7-49.1)	58.6 (56.5-60.7)	38.2 (38.0-38.8)	35.1 (34.1-36.1)	34.6 (33.5-35.7)	45.6 (44.0-47.3)	50.4 (47.6-53.3)	46.0 (45.2-46.7)	45.6 (44.4-46.7)	39.0 (37.8-40.2)	50.2 (48.5-52.0)	66.2 (63.0-69.5)
Spain (n=4698)	44.0 (43.5-44.5)	36.0 (35.3-36.7)	45.4 (44.5-46.4)	56.2 (54.9-57.5)	50.0 (48.1-52.0)	42.7 (42.0-43.4)	33.3 (32.3-34.3)	42.6 (41.4-43.9)	57.9 (56.1-59.8)	54.3 (51.5-57.3)	45.1 (44.4-45.9)	38.0 (37.0-39.1)	48.0 (46.7-49.4)	54.6 (52.8-56.4)	46.7 (44.0-49.4)
Italy (n=4508)	49.7 (49.1-50.2)	47.6 (46.8-48.5)	50.1 (49.2-51.1)	52.0 (50.8-53.3)	52.4 (50.4-54.4)	45.7 (45.0-46.4)	41.0 (40.0-42.1)	45.9 (44.6-47.2)	50.7 (49.0-52.5)	56.8 (53.8-59.8)	52.9 (52.1-53.7)	52.6 (51.4-53.9)	54.0 (52.6-55.4)	53.5 (51.7-55.3)	48.0 (45.3-50.7)
France (n=3630)	46.0 (45.5-46.5)	43.2 (42.4-44.0)	43.3 (42.4-44.2)	54.2 (52.9-55.5)	51.4 (49.5-53.5)	41.3 (40.6-42.0)	38.0 (37.0-39.1)	34.7 (33.6-35.9)	53.0 (51.3-54.8)	56.0 (53.2-59.1)	50.0 (49.3-50.8)	47.4 (46.3-48.6)	50.5 (49.2-51.9)	55.0 (53.2-56.9)	49.2 (46.5-52.0)
Denmark (n=3543)	37.0 (36.5-37.5)	35.3 (34.6-36.1)	30.9 (30.1-31.6)	42.0 (40.9-43.1)	58.9 (56.8-61.1)	35.4 (34.7-36.0)	33.5 (32.6-34.5)	31.1 (30.1-32.2)	38.0 (36.5-39.5)	56.5 (53.5-59.5)	38.3 (37.7-39.0)	36.8 (35.8-37.9)	30.6 (29.6-31.7)	45.4 (43.8-47.1)	60.4 (57.4-63.5)
Greece (n=4349)	45.0 (44.5-45.5)	39.2 (38.4-39.9)	44.8 (43.9-45.8)	54.0 (52.8-55.3)	53.3 (51.3-55.4)	42.7 (42.0-43.4)	37.4 (36.3-38.4)	39.7 (38.5-40.9)	54.4 (52.7-56.3)	53.9 (51.0-56.8)	47.0 (46.3-47.7)	40.4 (39.4-41.5)	49.9 (48.6-51.3)	53.7 (51.9-55.5)	52.8 (50.0-55.7)
Switzerland (n=2705)	38.8 (38.3-39.2)	33.5 (32.8-34.2)	33.6 (32.8-34.4)	50.9 (49.7-52.2)	57.2 (55.1-59.4)	34.6 (33.9-35.2)	31.0 (30.1-32.0)	28.1 (27.1-29.2)	43.1 (41.5-44.7)	58.3 (55.4-61.4)	42.6 (41.9-43.3)	35.3 (34.3-36.3)	39.0 (37.8-40.2)	58.0 (56.2-59.9)	56.5 (53.6-59.5)
Belgium (n=5333)	43.4 (42.9-43.9)	41.2 (40.4-42.0)	40.8 (39.9-41.6)	50.2 (49.0-51.5)	49.2 (47.3-51.2)	40.4 (39.7-41.1)	36.3 (35.3-37.3)	37.3 (36.2-38.5)	47.7 (46.0-49.4)	56.9 (54.0-60.0)	46.0 (45.2-46.7)	45.1 (44.0-46.2)	43.9 (42.7-45.2)	52.3 (50.5-54.1)	42.8 (40.3-45.4)
Israel (n=1579)	41.2 (40.7-41.7)	34.1 (33.4-34.8)	41.5 (40.6-42.4)	52.7 (51.5-54.0)	49.0 (47.0-50.9)	39.1 (38.5-39.8)	30.2 (29.3-31.2)	40.2 (39.0-41.4)	52.6 (50.8-54.4)	47.8 (45.2-50.6)	42.7 (42.0-43.4)	36.6 (35.5-37.6)	42.5 (41.3-43.8)	52.9 (51.1-54.7)	50.0 (47.3-52.9)
Czech Republic (n=4427)	42.3 (41.8-42.8)	37.5 (36.8-38.3)	37.7 (36.9-38.6)	52.8 (51.5-54.1)	59.9 (57.7-62.1)	39.0 (38.3-39.7)	31.1 (30.2-32.1)	36.0 (34.8-37.1)	50.5 (48.8-52.3)	64.5 (61.4-67.7)	44.3 (43.6-45.0)	41.5 (40.4-42.6)	39.0 (37.8-40.2)	54.5 (52.7-56.3)	55.6 (52.7-58.6)
Poland (n=1628)	47.3 (46.8-47.8)	40.6 (39.8-41.3)	51.1 (50.1-52.1)	55.8 (54.5-57.1)	45.6 (43.7-47.5)	44.2 (43.5-44.9)	36.3 (35.3-37.3)	44.8 (43.6-46.1)	54.2 (52.5-56.1)	58.3 (55.4-61.4)	50.1 (49.4-50.9)	44.0 (42.8-45.1)	56.5 (55.0-57.9)	57.1 (55.3-59.0)	38.6 (36.2-41.2)
Luxembourg (n=1427)	42.8 (42.3-43.3)	38.4 (37.7-39.1)	40.2 (39.4-41.1)	49.7 (48.5-50.9)	58.8 (56.7-61.0)	36.2 (35.6-36.9)	31.8 (30.9-32.8)	33.5 (32.4-34.6)	43.8 (42.2-45.5)	52.0 (49.2-54.9)	48.7 (48.0-49.5)	43.3 (42.2-44.4)	47.4 (46.1-48.7)	55.8 (54.0-57.7)	65.4 (62.3-68.6)
Portugal (n=1412)	47.6 (47.0-48.1)	44.2 (43.4-45.0)	49.7 (48.8-50.7)	52.2 (51.0-53.5)	44.2 (42.4-46.1)	45.2 (44.5-46.0)	37.9 (36.9-39.0)	48.2 (46.9-49.6)	59.5 (57.7-61.4)	35.0 (32.7-37.4)	48.7 (47.9-49.4)	48.5 (47.4-49.7)	51.0 (49.7-52.4)	44.5 (42.9-46.2)	50.0 (47.3-52.9)
Slovenia (n=3834)	36.4 (36.0-36.9)	29.2 (28.6-29.9)	35.2 (34.4-36.0)	47.0 (45.8-48.1)	53.2 (51.2-55.2)	34.0 (33.4-34.7)	25.5 (24.7-26.4)	31.4 (30.3-32.4)	45.9 (44.3-47.6)	60.3 (57.3-63.4)	38.4 (37.7-39.0)	31.9 (30.9-32.8)	38.5 (37.3-39.7)	47.7 (46.0-49.4)	48.7 (46.0-51.5)
Estonia (n=4856)	52.8 (52.3-53.4)	49.1 (48.3-50.0)	53.1 (52.1-54.0)	60.0 (58.7-61.3)	53.1 (51.1-55.2)	50.5 (49.8-51.3)	43.6 (42.5-44.8)	51.0 (49.7-52.4)	61.6 (59.7-63.5)	56.7 (53.8-59.8)	54.4 (53.6-55.2)	52.7 (51.5-54.0)	54.3 (52.9-55.8)	59.2 (57.3-61.1)	51.1 (48.3-54.0)
Croatia (n=2210)	44.6 (44.1-45.1)	40.7 (39.9-41.5)	47.1 (46.2-48.1)	46.0 (44.8-47.2)	51.0 (49.0-53.0)	41.0 (40.4-41.7)	35.9 (34.9-36.9)	42.8 (41.4-44.1)	43.3 (41.7-44.9)	55.6 (52.7-58.6)	47.6 (46.9-48.4)	44.4 (43.2-45.5)	51.3 (50.0-52.7)	48.0 (46.4-49.7)	48.5 (45.8-51.3)
Total (n=60816)	42.9 (42.4-43.4)	38.7 (37.9-39.4)	41.7 (40.8-42.6)	50.5 (49.3-51.8)	52.3 (50.3-54.3)	39.7 (39.1-40.4)	34.3 (33.4-35.3)	38.0 (36.9-39.2)	48.7 (47.0-50.4)	54.3 (51.4-57.2)	45.4 (44.7-46.1)	41.8 (40.8-43.0)	45.0 (43.7-46.3)	52.1 (50.4-53.9)	51.2 (48.4-54.1)

Table 2 Prevalence of frailty across Europe

	Overall					Male					Female				
	Overall prevalence (95% CI)	Standardised prevalence rates (95% CI)				Overall prevalence (95% CI)	Standardised prevalence rates (95% CI)				Overall prevalence (95% CI)	Standardised prevalence rates (95% CI)			
		50-64	65-74	75-84	≥85		50-64	65-74	75-84	≥85		50-64	65-74	75-84	≥85
Austria (n=2901)	7.2 (6.9-7.4)	1.6 (1.5-1.8)	4.4 (4.1-4.7)	11.6 (11-12.2)	37.2 (35.6-39.0)	5.9 (5.6-6.1)	2.5 (2.3-2.8)	4.2 (3.8-4.6)	8.6 (7.9-9.4)	23.9 (22.0-25.9)	8.0 (7.7-8.3)	1.0 (0.8-1.2)	4.6 (4.2-5.0)	13.7 (12.8-14.6)	45.1 (42.5-47.9)
Germany (n=4094)	5.2 (5.1-5.4)	1.9 (1.7-2.1)	2.5 (2.3-2.7)	9.6 (9.0-10.1)	23.5 (22.2-24.9)	4.1 (3.9-4.3)	1.2 (1.0-1.4)	2.4 (2.2-2.8)	7.1 (6.4-7.7)	18.4 (16.8-20.2)	6.4 (6.2-6.7)	2.4 (2.1-2.7)	2.6 (2.3-2.9)	12.6 (11.7-13.5)	28.6 (26.5-30.8)
Sweden (n=3682)	4.2 (4.0-4.4)	1.8 (1.7-2.0)	2.0 (1.8-2.2)	7.1 (6.6-7.5)	18.7 (17.5-19.9)	3.4 (3.2-3.6)	0.9 (0.7-1.1)	0.7 (0.6-0.9)	6.5 (5.9-7.2)	20.2 (18.4-22.0)	4.9 (4.6-5.1)	2.6 (2.4-2.9)	3.0 (2.7-3.4)	7.6 (7.0-8.3)	17.3 (15.7-19.0)
Spain (n=4698)	11.2 (11.0-11.5)	4.1 (3.8-4.3)	8.1 (7.7-8.5)	19.2 (18.5-20.0)	42.2 (40.4-44.0)	8.3 (8.0-8.7)	3.2 (2.9-3.5)	5.8 (5.3-6.3)	12.1 (11.3-13.0)	37.1 (34.7-39.6)	13.8 (13.4-14.2)	4.8 (4.4-5.2)	10.2 (9.6-10.9)	25.8 (24.5-27.0)	46.2 (43.5-48.9)
Italy (n=4508)	11.0 (10.7-11.2)	4.3 (4.1-4.5)	8.4 (8.0-8.8)	19.6 (18.8-20.4)	35.4 (33.7-37.1)	7.9 (7.6-8.2)	3.4 (3.1-3.7)	5.4 (5.0-5.9)	14.9 (13.9-15.8)	24.3 (22.4-26.3)	14.0 (13.6-14.4)	5.0 (4.6-5.4)	11.1 (10.4-11.7)	24.9 (23.7-26.2)	46.6 (43.9-49.3)
France (n=3630)	9.1 (8.9-9.3)	3.0 (2.8-3.2)	5.6 (5.3-5.9)	15.6 (14.9-16.3)	40.3 (38.5-42.1)	6.9 (6.6-7.1)	2.0 (1.8-2.3)	4.8 (4.4-5.3)	11.4 (10.6-12.3)	29.7 (27.6-31.9)	10.6 (10.3-11.0)	3.8 (3.4-4.1)	6.2 (5.7-6.7)	18.6 (17.6-19.7)	45.5 (42.9-48.2)
Denmark (n=3543)	5.0 (4.9-5.2)	0.9 (0.7-1.0)	3.3 (3.1-3.6)	10.0 (9.5-10.6)	22.0 (20.7-23.4)	4.2 (4.0-4.4)	0.6 (0.5-0.8)	2.7 (2.4-3.1)	8.0 (7.3-8.7)	19.4 (17.7-21.2)	5.8 (5.5-6.1)	1.0 (0.9-1.2)	4.0 (3.6-4.4)	11.7 (10.9-12.6)	23.6 (21.7-25.6)
Greece (n=4349)	9.9 (9.7-10.2)	4.4 (4.2-4.7)	7.0 (6.7-7.4)	16.8 (16.1-17.6)	33.9 (32.3-35.5)	7.7 (7.4-8.0)	3.7 (3.4-4.1)	5.6 (5.1-6.0)	11.7 (10.8-12.5)	27.5 (25.5-29.6)	11.9 (11.6-12.3)	4.9 (4.5-5.2)	8.5 (7.9-9.0)	21.3 (20.2-22.5)	40.5 (38.0-43.0)
Switzerland (n=2705)	3.0 (2.8-3.1)	1.0 (0.9-1.1)	2.0 (1.8-2.2)	4.4 (4.0-4.8)	13.9 (12.9-15.0)	2.8 (2.6-3.0)	1.4 (1.2-1.6)	2.6 (2.3-2.9)	3.9 (3.4-4.4)	8.3 (7.2-9.6)	3.0 (2.9-3.2)	0.7 (0.5-0.8)	1.5 (1.2-1.7)	4.9 (4.4-5.5)	17.6 (16.0-19.3)
Belgium (n=5333)	9.4 (9.2-9.7)	4.0 (3.8-4.3)	5.4 (5.1-5.8)	16.6 (15.9-17.3)	36.9 (35.2-38.6)	6.9 (6.6-7.2)	3.0 (2.7-3.3)	4.1 (3.7-4.5)	12.8 (12.0-13.7)	24.3 (22.4-26.3)	11.6 (11.2-11.9)	4.9 (4.5-5.3)	6.6 (6.2-7.1)	19.5 (18.5-20.6)	47.4 (44.7-50.2)
Israel (n=1579)	14.0 (13.7-14.3)	6.4 (6.1-6.7)	11.6 (11.1-12.1)	21.5 (20.7-22.3)	45.8 (44.0-47.7)	12.9 (12.5-13.3)	5.6 (5.2-6.0)	9.5 (8.9-10.1)	20.0 (18.9-21.1)	47.8 (45.2-50.6)	14.9 (14.5-15.3)	7.0 (6.5-7.4)	13.3 (12.6-14.1)	22.8 (21.7-24.0)	44.0 (41.4-46.7)
Czech Republic (n=4427)	7.2 (7.0-7.4)	3.1 (2.9-3.3)	5.3 (5.0-5.6)	12.4 (11.8-13.1)	24.2 (22.9-25.6)	5.9 (5.7-6.2)	3.3 (3.0-3.6)	4.3 (3.9-4.7)	7.9 (7.2-8.6)	22.4 (20.6-24.3)	8.2 (7.9-8.5)	3.0 (2.7-3.3)	6.0 (5.5-6.5)	15.9 (14.9-16.9)	25.9 (24.0-28.0)
Poland (n=1628)	13.1 (12.8-13.4)	2.9 (2.7-3.1)	8.2 (7.8-8.5)	29.8 (28.9-30.8)	45.6 (43.7-47.5)	11.0 (10.7-11.4)	2.6 (2.3-2.8)	8.6 (8.1-9.2)	25.4 (24.2-26.7)	29.2 (27.1-31.4)	14.5 (14.1-14.9)	3.1 (2.9-3.5)	7.8 (7.2-8.3)	33.6 (32.2-35.0)	54.6 (51.7-57.5)
Luxembourg (n=1427)	6.0 (5.8-6.2)	1.7 (1.5-1.8)	5.1 (4.8-5.4)	12.0 (11.4-12.6)	17.6 (16.5-18.9)	5.4 (5.2-5.7)	0.6 (0.5-0.8)	2.7 (2.4-3.1)	15.7 (14.8-16.7)	16.0 (14.5-17.7)	6.5 (6.2-6.8)	2.5 (2.2-2.8)	7.7 (7.1-8.2)	8.1 (7.5-8.9)	19.2 (17.6-21.0)
Portugal (n=1412)	15.6 (15.3-15.9)	5.9 (5.7-6.2)	12.2 (11.7-12.6)	28.6 (27.7-29.5)	48.1 (46.2-50.0)	11.5 (11.2-11.9)	1.7 (1.5-2.0)	8.0 (7.4-8.5)	19.1 (18.0-20.1)	60.0 (57.0-63.1)	19.3 (18.8-19.8)	8.8 (8.3-9.3)	15.8 (15.0-16.5)	38.7 (37.2-40.2)	40.6 (38.2-43.2)
Slovenia (n=3834)	7.6 (7.4-7.8)	1.8 (1.6-2.0)	4.7 (4.5-5.0)	16.9 (16.2-17.6)	26.3 (24.9-27.8)	5.9 (5.7-6.2)	1.4 (1.2-1.6)	4.2 (3.8-4.6)	13.0 (12.2-13.9)	19.2 (17.5-21.0)	8.7 (8.4-9.0)	2.1 (1.8-2.3)	5.2 (4.8-5.7)	19.5 (18.5-20.6)	30.8 (28.6-33.0)
Estonia (n=4856)	8.5 (8.3-8.7)	2.2 (2.0-2.3)	5.3 (5.0-5.6)	15.8 (15.1-16.4)	37.2 (35.6-39.0)	7.4 (7.1-7.7)	1.7 (1.5-1.9)	5.9 (5.4-6.4)	12.2 (11.4-13.1)	31.7 (29.6-34.0)	9.1 (8.8-9.4)	2.5 (2.2-2.7)	4.9 (4.5-5.3)	17.5 (16.5-18.6)	40.3 (37.9-42.9)
Croatia (n=2210)	11.0 (10.7-11.2)	2.9 (2.7-3.1)	7.7 (7.3-8.0)	21.5 (20.8-22.4)	41.2 (39.4-43.0)	8.1 (7.8-8.5)	1.8 (1.6-2.0)	6.1 (5.7-6.6)	14.9 (14.0-15.9)	33.3 (31.1-35.7)	13.1 (12.7-13.5)	3.7 (3.4-4.1)	9.1 (8.6-9.7)	26.6 (25.3-27.8)	45.5 (42.9-48.2)
Total (n=60816)	7.7 (7.5-8.0)	3.0 (2.8-3.2)	6.0 (5.7-6.4)	16.0 (15.4-16.8)	32.8 (31.2-34.4)	6.0 (5.8-6.3)	2.3 (2.0-2.5)	4.9 (4.5-5.3)	12.5 (11.7-13.4)	27.4 (25.4-29.5)	9.1 (8.8-9.4)	3.5 (3.2-3.9)	7.1 (6.6-7.6)	19.1 (18.0-20.2)	36.6 (34.3-39.1)

Table 3 Prevalence of the criteria used in frailty assessment

	Exhaustion			Appetite			Slowness			Low activity			Weakness		
	Overall	Male	Female	Overall	Male	Female	Overall	Male	Female	Overall	Male	Female	Overall	Male	Female
Overall (n=60816)	**35.7 (35.2-36.1)**	**30.1 (29.5-30.7)**	**40.1 (39.4-40.7)**	**8.3 (8.1-8.6)**	**6.6 (6.3-6.9)**	**9.7 (9.4-10.1)**	**5.5 (5.4-5.7)**	**4.5 (4.3-4.7)**	**6.4 (6.1-6.7)**	**16.2 (15.9-16.5)**	**15.1 (14.7-15.6)**	**17.0 (16.6-17.5)**	**15.8 (15.5-16.1)**	**14.3 (13.9-14.7)**	**17.0 (16.6-17.5)**
50-64 (n=25712)	**30.7 (30.1-31.4)**	**25.2 (24.4-26.1)**	**34.8 (33.8-35.8)**	**6.4 (6.1-6.7)**	**5.1 (4.7-5.5)**	**7.3 (6.8-7.8)**	**2.1 (1.9-2.3)**	**1.9 (1.7-2.1)**	**2.2 (2.0-2.5)**	**11.9 (11.5-12.3)**	**11.8 (11.3-12.4)**	**11.9 (11.3-12.5)**	**6.1 (5.8-6.4)**	**4.7 (4.4-5.1)**	**7.2 (6.7-7.6)**
65-74 (n=20041)	**33.2 (32.4-33.9)**	**28.0 (27.0-29.1)**	**37.7 (36.6-38.9)**	**7.4 (7.0-7.8)**	**5.7 (5.2-6.2)**	**8.9 (8.3-9.5)**	**4.8 (4.5-5.1)**	**4.1 (3.7-4.5)**	**5.4 (4.9-5.8)**	**14.6 (14.1-15.1)**	**14.1 (13.4-14.9)**	**15.1 (14.3-15.8)**	**13.3 (12.8-13.8)**	**11.5 (10.8-12.1)**	**14.9 (14.1-15.6)**
75-84 (n=11891)	**44.5 (43.4-45.7)**	**38.2 (36.7-39.7)**	**50.1 (48.4-51.8)**	**12.2 (11.6-12.8)**	**9.4 (8.7-10.2)**	**14.6 (13.7-15.5)**	**10.7 (10.1-11.3)**	**8.4 (7.7-9.2)**	**12.5 (11.7-13.4)**	**24.2 (23.3-25.0)**	**20.8 (19.7-21.9)**	**27.2 (25.9-28.5)**	**32.7 (31.7-33.7)**	**30.3 (29.0-31.7)**	**34.7 (33.3-36.2)**
≥85 (n=3172)	**54.2 (52.2-56.3)**	**48.7 (46.0-51.5)**	**58.2 (55.3-61.3)**	**17.1 (16.0-18.3)**	**12.8 (11.4-14.3)**	**20.2 (18.5-22.1)**	**22.0 (20.7-23.4)**	**16.3 (14.8-18.0)**	**25.9 (23.9-27.9)**	**41.1 (39.4-43.0)**	**35.7 (33.4-38.1)**	**45.1 (42.5-47.8)**	**59.4 (57.3-61.6)**	**58.9 (55.9-61.9)**	**60.1 (57.1-63.3)**

Discussion

A population's ageing is challenging for the sustainability of health care systems across Europe (21). Awareness of and concerns about the impact of geriatric syndromes on clinical outcomes and quality of life of the elderly, as well as issues related to the economic burden caused by ageing, is increasing (9). It is thus important to redesign care processes to answer the needs of the elderly, especially for complex patients such as those who are frail. Frailty is a geriatric syndrome that results from the accumulation of defects in various physiological systems (9,10). Although this syndrome is widely recognised, there is still debate on what is the best way to assess it. Many operational definitions have been introduced to try to distinguish frail from non-frail individuals. Due to its multiplicity of definitions and tools to assess it, the prevalence of frailty has been reported to be between 4.0–59.1% in community-based studies (11,22). The estimated prevalence of frailty in elderly populations varies largely, due to the heterogeneity of criteria used to define it – a problem that hinders geographical comparisons (23). Therefrom arose the need for a study of the prevalence of the frailty condition at the European level, using the same methodology, so those results could be compared among countries. Indeed, the aim of this study was to evaluate the prevalence of frailty status in the 18 countries included in SHARE's wave 6 and the impact of each of the five criteria taken into consideration. Fried's Phenotype, which consists of five different criteria: weakness, shrinking, exhaustion, low activity and slowness, is commonly used; indeed, it is considered a 'gold standard' for measuring frailty (10,24). In this study we adopted an operationalised version of these criteria to the SHARE survey, that has already proven to be a robust tool in identifying populations most at risk of developing adverse outcomes (17,25).

We found that 38.7% of all the individuals aged between 50 and 64 were pre-frail and 3.0% were frail, while individuals aged 85 or more years were 1.4-fold more pre-frail and 10.9-fold frailer. Also, women appear to be more likely to develop this condition, since they presented higher percentages of frailty (16.4% vs 8.6% in men) and pre-frailty (43.4% vs 38.1% in men) (25). This is an effect

largely reported in several studies. One of the possible explanations can be quality of life, which disfavours the female population (27). Comparing data from 2004 (wave 1) with the 2015 data used in our study (wave 6), it is possible to observe that women were almost twice as frail as men. However, the 2015 data showed that women were only 1.5-fold more prone to be frail. Also, there was an increase in the pre-frail population (39.6% vs 42.9%) and a decrease in the frail population (9.9% vs 7.7%)(17). Transposing the prevalence values for the population aged 50 or more years, living in 2015 in the 17 European countries represented, this means that of all 150,131,950 individuals, 64,406,607 were pre-frail and 11,560,160 were frail. These numbers are of major importance, showing that interventions are needed to enhance citizens' health and quality of life across Europe. By such means there could be an improvement in the sustainability and effectiveness of health and care systems, thereby relieving the economic burden associated with this syndrome.

The prevalence of frailty was also evaluated in wave 2 of SHARE, with different results: in this study the prevalence of pre-frailty and frailty were 41.1% and 12.9%, respectively. Although in this study only individuals 60 or more years old were included (and this must be considered when comparing results), which may be an explanation of why the prevalences are higher than those found with waves 1 and 6 (25). As has been reported in several studies already (17,18,26), our findings corroborate that frailty is a condition that becomes more prevalent as age advances.

The prevalence of frailty was found to be unequal across different countries. Northern European countries present lower prevalences of pre-frailty and frailty compared to Southern European countries. This same tendency was already observed in other studies about frailty (17,18,28) and is in agreement with other health indicators studied in SHARE that showed worsening conditions as one went from Northern to Southern Europe. Comparing our results to those of wave 1, some important changes arose. In the age group 50–64 prevalences of pre-frailty and frailty decreased in Austria (1.5% and 2.3%, respectively), in Switzerland (2.6% and 0.3%, respectively) and in Spain (8.9% and 3.4%, respectively). On the other side, for this age group, in Greece there was an increase

of 5.7% for pre-frailty and 1.6% for frailty prevalences. In the other countries the tendency was the same: an increase in pre-frailty prevalence (5.0% in Sweden, 0.4% in Denmark, 5.5% in Germany, 1.9% in France, and 4.1% in Italy) and a decrease of frailty prevalence (0.1% in Sweden, 2.1% in Denmark, 0.7% in Germany, 0.2% in France and 1.6% in Italy). For the older population (65 or more years old), a decrease in pre-frailty and frailty prevalences was also observed in Sweden (5.4% and 3.2%, respectively), Denmark (1.7% and 6.4%, respectively), Austria (3.5% and 0.9%, respectively), Switzerland (4.7% and 1.7% respectively), and Spain (1.0% and 11.1%, respectively). In Germany, France, Italy and Greece an increase in pre-frailty prevalence (4.9%, 4.5%, 5.3% and 4.0%, respectively) and a decrease in frailty prevalence (5.7%, 1.4%, 8.8% and 2.0%, respectively) were observed. For the other countries included in wave 6 no comparison was available, once they were not included in wave 1 (17). These changes could be a product of the increasing awareness of frailty, as health care professionals and researchers have been focusing more in this subject over the last several years. In fact, there have been health policy initiatives created (29–31) that focus on postponing/preventing frailty among the elderly.

Regarding the five criteria, exhaustion seems to be the one with the highest weight in frailty assessment for both the 50–64 and 65+ year age groups. In the 50–64 age group, exhaustion (30.7%) was followed by low activity (11.9%), shrinking (6.4%), weakness (6.1%) and slowness (2.1%). Comparing these results with those obtained in wave 1, no major changes are noticed, except for slowness, which affected 6.7% of total population in 2004 and had a decrease of 4.6% in 2015. In the older participants, 65+ years old, exhaustion (38.9%) was followed by weakness (24.0%), low activity (20.3%), shrinking (9.9%) and slowness (8.4), which also had a decrease since 2004 of 14.3%. This difference between the prevalence of the weakness criteria between age groups can be linked to the physical decline that occurs with age. Lower levels of slowness may be a result of increased population awareness of physical exercise and other initiatives that have been developed for promotion of physical exercise for the older population.

There are some limitations in this study that should be noted. Most of the data used in this study (as drawn from SHARE) are self-reported; this raises some questions regarding their validity. Indeed, four of the five questions used in the frailty assessment were subjective; only one (weakness) was objective. Also, it is well known that most people who volunteer to take part in studies such as this are healthier than their peers. Thus, people with more illnesses may not have been included in the study; this may have influenced the prevalences.

In conclusion, pre-frailty and frailty were found to be highly prevalent across Europe. This is a dynamic process that must be understood as a continuum with intermediate stages that can be modified (24). Frailty is not an inevitable consequence of ageing, nor is it a unidirectional process. It must be identified early; this may help health and social care professionals take action, thereby improving outcomes and avoiding unnecessary harm/costs (32). With this work we demonstrated that almost 43% of the population aged 50 or more years are pre-frail, and almost 8% are frail. This means that more than 50% of the European population suffer a frailty status, a fact that must be considered when designing interventions to reduce/postpone/mitigate the progression of this process.

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